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# South Carolina Infant Mortality Statistics Final 2001 Data

An Update to the Report of 1999 Data

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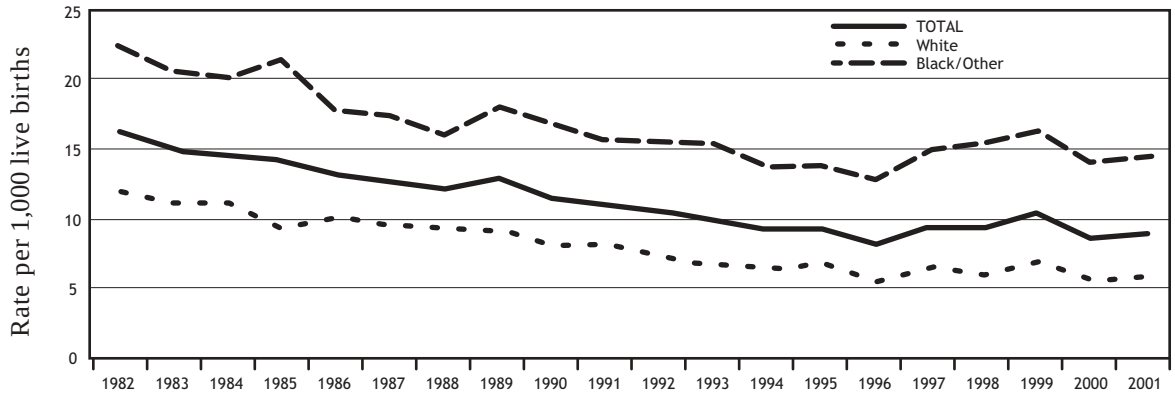
## Introduction

High infant mortality rates continue to be an important public health concern in South Carolina. From 1982-1996, the infant mortality rate followed a decreasing trend (Figure 1). During this time, the infant mortality rate decreased almost by half (48%) from 16.1 in 1982 to 8.3 in 1996, the lowest infant mortality rate to date. More recently, the infant mortality rate seems to have leveled around 9.4, for the two years prior to 1996, and 9.5, for the two years after 1996. An exception to the infant mortality rate remaining stable throughout the five year period from 1994-1998 is the year 1996, the midpoint of the interval. Following this five year period, the infant mortality rate fluctuated rising to 10.3 in 1999 and then dropping to 8.7 infant deaths per 1000 live births in 2000. The rate then increased by 2.3% to 8.9 in 2001 (496 infant deaths, 55,748 live births).

**Figure 1. SC Infant Mortality Rates by Race, 1982–2001 Residence Data**




Note: Race of infant (1982 - 1989); Race of mother (1990 - 2001)

| | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | 1988 | 1989 | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL | 16.1 | 15.0 | 14.7 | 14.2 | 13.2 | 12.8 | 12.2 | 12.8 | 11.6 | 11.2 | 10.5 | 10.1 | 9.4 | 9.4 | 8.3 | 9.5 | 9.5 | 10.3 | 8.7 | 8.9 |
| White | 12.0 | 11.3 | 11.1 | 9.5 | 10.2 | 9.7 | 9.5 | 9.1 | 8.2 | 8.1 | 7.2 | 6.7 | 6.6 | 6.7 | 5.5 | 6.3 | 6.0 | 6.8 | 5.5 | 5.8 |
| Black/Other | 22.2 | 20.6 | 20.2 | 21.4 | 17.9 | 17.5 | 16.2 | 18.2 | 16.9 | 15.9 | 15.5 | 15.4 | 13.8 | 14.1 | 13.0 | 15.0 | 15.5 | 16.4 | 14.2 | 14.5 |

From 2000 to 2001, South Carolina's infant mortality rate increased by 5.5 % among whites (from 5.5 to 5.8). There were 206 infant deaths and 35,731 live births to white mothers during 2001. Among black and other mothers the rate increased from 14.2 in 2000 to 14.5 in 2001, an increase of 2.1%. There were 290 infant deaths and 20,008 live births to black and other mothers during 2001. Five-year infant mortality rates and 95% confidence intervals are shown in Table 1. The neonatal (<28 days) mortality rate for infants of black and other mothers and the postneonatal (28+ days) mortality rate for infants of white mothers increased by 2.0% and 25.0% respectively in 2001 compared to 2000.

**Table 1. Five-year Infant Mortality Rates[1] with 95% Confidence Intervals[2] SC Residence Data**

| Years | Number of Infant Deaths | Number of Live Births | Infant Mort. Rate | 95% Confidence Interval |
|---|---|---|---|---|
| 1982-1986 | 3,755 | 256,418 | 14.6 | (14.2 ,15.1) |
| 1987-1991 | 3,400 | 281,081 | 12.1 | (11.7 ,12.5) |
| 1992-1996 | 2,522 | 263,742 | 9.6 | (9.2 ,9.9) |
| 1997-2001 | 2,553 | 272,456 | 9.4 | (9.0 ,9.7) |

[1] Rates per 1,000 live births
[2] $r=61.981\ (r/n)^{1/2}$, where r=infant mortality rate and n=number of live births

*Infant mortality rates were exponentially higher among the lowest birth weights.*

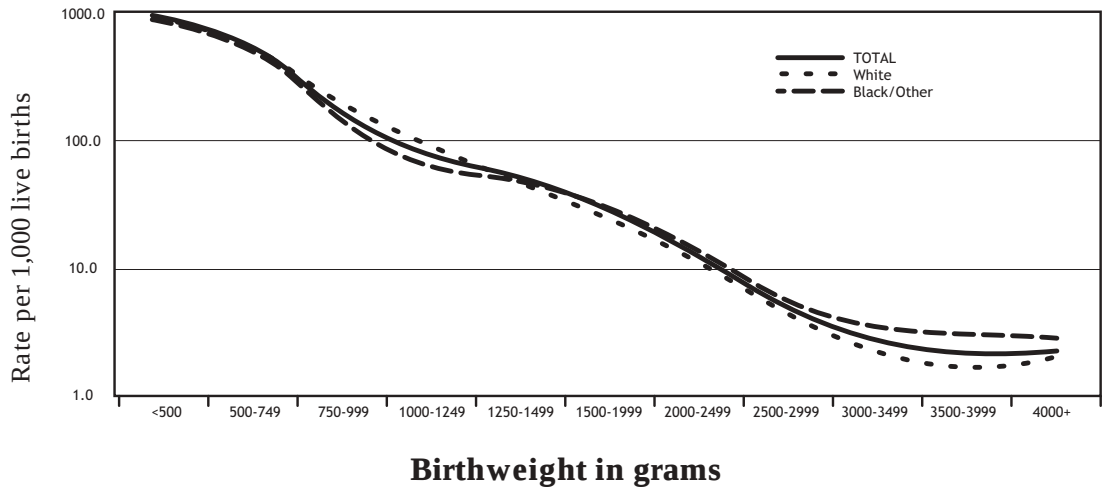
Analyses were conducted to examine characteristics of infant mortality to South Carolina resident mothers in 2001 and in previous years. Highlights of these analyses are described here: birthweight-specific mortality rates, trends, leading causes of infant death, PRAMS linkage results, and GIS analysis.

## Birthweight-Specific Infant Mortality Rates

Over the past three years (1999-2001), mortality rates for very low birthweight infants (VLBW:<1500 g) decreased from 285.5 in 1999 to 277.5 per 1,000 live births in 2001; for moderately low birthweight infants (MLBW:1500-2499 g) from 16.6 to 11.9; and for normal birthweight infants (NBW:2500+ g) from 3.4 to 3.0 (data not shown). Across all three birthweight groups, these rates were higher among the black and other race group during this three year period.

A line graph depicting the relationship of infant mortality rates with 11 consecutive birthweight groups is shown in Figure 2. The mortality rate is based on a logarithmic scale. The graphing of birthweight-specific mortality rates revealed that infant mortality rates were exponentially higher among the lowest birthweights. Almost all infants weighing <500 grams experienced an infant death, while the mortality rate for normal birthweight infants was extremely low. Mortality rates decreased as birthweight increased, up to about 3500-3999 grams. This trend was consistent across the race groups and has remained constant over the past decade.

**Figure 2. Birthweight-Specific Infant Mortality Rates[1] by Maternal Race[2] 1996-2000 Residence Data from Cohort files**




[1] Rate per 1,000 live births
[2] Race breakdown for all years is mother's race
Note: Rate scale is logarithmic

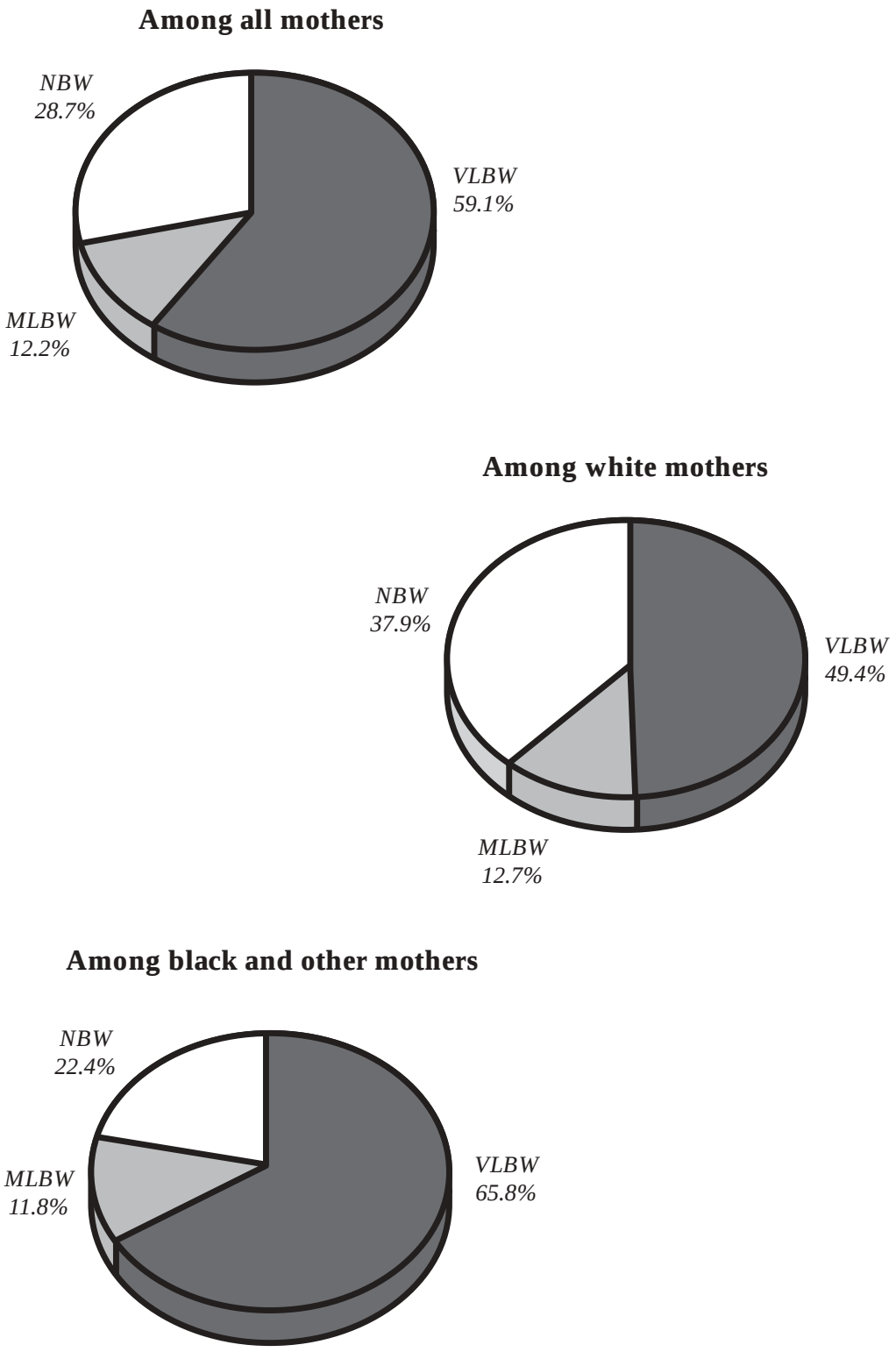
| | <500 | 500-749 | 750-999 | 1000-1249 | 1250-1499 | 1500-1999 | 2000-2499 | 2500-2999 | 3000-3499 | 3500-3999 | 4000+ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| TOTAL | 914.1 | 537.4 | 162.4 | 70.5 | 47.8 | 26.4 | 12.4 | 4.5 | 2.8 | 2.0 | 2.1 |
| White | 903.7 | 503.1 | 190.5 | 86.0 | 45.5 | 23.4 | 11.1 | 4.4 | 2.6 | 1.6 | 1.9 |
| Black/Other | 918.3 | 555.0 | 144.8 | 56.9 | 49.7 | 29.3 | 13.7 | 4.6 | 3.2 | 3.2 | 2.8 |

The percentage of infant deaths by birthweight group for white mothers and for black and other mothers is shown in Figure 3. Overall, 59.1% of infant deaths involved VLBW infants. Just under half of the infants who were born to white mothers and who died under one year of age were VLBW. By comparison, almost two-thirds of the infants who were born to black and other mothers and who died before their first birthday were VLBW. Nearly 37.9% of white mothers who experienced an infant death had a NBW infant, compared to 22.4% of black and other mothers.

*Overall, 59.1% of infant deaths involved VLBW infants.*

*Nearly 38% of white mothers who experienced an infant death had a NBW infant, compared to 22.4% of black and other mothers.*

**Figure 3. Percentage of Infant Deaths by Birthweight Group, 1999-2001 Residence Data**



## Maternal Characteristics Across Three Time Periods

Trend tables were developed to assess possible demographic shifts in South Carolina's maternal population. For comparison purposes, three time periods were used to represent 1993-1995, 1996-1998, and 1999-2001 infant mortality rates. Percentages of selected maternal characteristics were investigated for trends in accordance with the rate changes across these time periods.

Demographic, perinatal, and pregnancy outcome characteristics were examined for white mothers and for black and other mothers. These characteristics included paternal race and both maternal and paternal age group, education, and Hispanic status. Maternal smoking and drinking were also investigated. Table 2 shows percentages of selected characteristics for all live births for nine years. For both race groups, the percentage of mothers losing weight during pregnancy, and mothers with a higher education (more than high school) had increased. The percentage of Hispanic Mothers was on the rise across the races. Mothers in both race groups experienced an increasing number of multiple births. Black and other mothers who received Adequate prenatal care (Kessner Index) had increased. The percentage of VLBW infants born to black and other mothers was at least twice as high as the percentage of VLBW infants born to white mothers. The percentage of MLBW infants born to black and other mothers was approximately 80% higher than the percentage of MLBW infants born to white mothers.

*Black and other mothers who received adequate prenatal care (kessner index) had increased.*

**Table 2. Selected Maternal Characteristics[1] for all Live Births across Three Time Periods, SC Residence Data**

| | 1993-1995 | | 1996-1998 | | 1999-2001 | |
|---|---|---|---|---|---|---|
| Characteristics | White Percent | Black & Other Percent | White Percent | Black & Other Percent | White Percent | Black & Other Percent |
| **Maternal Age** | | | | | | |
| Less than 18 years | 4.5 | 11.0 | 4.4 | 10.4 | 3.8 | 8.6 |
| 18-34 years | 86.3 | 82.2 | 84.8 | 81.9 | 84.9 | 83.8 |
| 35 or more years | 9.2 | 6.8 | 10.7 | 7.7 | 11.3 | 7.6 |
| **Maternal Education** | | | | | | |
| High School or less | 53.1 | 70.4 | 50.4 | 68.3 | 49.6 | 67.0 |
| More than High School | 46.6 | 29.1 | 49.1 | 30.8 | 49.9 | 32.3 |
| **Unmarried Mother** | 13.0 | 57.2 | 12.4 | 53.1 | 12.5 | 51.8 |
| **Hispanic Mother** | 1.9 | 0.3 | 3.1 | 0.6 | 6.1 | 1.0 |
| **Kessner Index of PNC** | | | | | | |
| Adequate | 74.8 | 52.2 | 77.4 | 58.9 | 76.2 | 60.4 |
| Intermediate | 18.7 | 31.9 | 15.8 | 26.4 | 15.8 | 25.5 |
| Inadequate | 5.0 | 14.3 | 4.5 | 12.2 | 5.1 | 10.7 |
| **Smoked during pregnancy** | 19.8 | 8.4 | 18.1 | 6.8 | 15.9 | 6.4 |
| **Drank during pregnancy** | 1.2 | 1.5 | 1.1 | 1.0 | 1.0 | 0.8 |
| **Number at Birth** | | | | | | |
| One | 97.5 | 97.4 | 97.2 | 97.3 | 96.9 | 96.9 |
| Two or more | 2.5 | 2.6 | 2.8 | 2.7 | 3.1 | 3.1 |
| **Weight Gain/Loss** | | | | | | |
| Weight lost | 0.2 | 0.5 | 0.3 | 0.7 | 0.7 | 1.5 |
| 1-24 lbs. gained | 27.4 | 38.8 | 28.5 | 38.0 | 29.0 | 39.2 |
| 25-34 lbs. gained | 34.5 | 29.1 | 32.6 | 28.1 | 31.6 | 26.9 |
| 35+ lbs. gained | 36.2 | 27.1 | 35.9 | 27.3 | 36.6 | 28.0 |
| **Birthweight Group** | | | | | | |
| VLBW | 1.2 | 2.9 | 1.2 | 3.1 | 1.3 | 3.2 |
| MLBW | 5.6 | 10.4 | 5.7 | 10.3 | 6.0 | 10.8 |
| NBW | 93.2 | 86.7 | 93.0 | 86.6 | 92.7 | 86.0 |

[1] Data is stratified by race of mother.
"Unknown" levels of each variable are not listed, but percentages are based on their inclusion.

Live Birth/Infant Death cohort files were used to examine characteristics associated with live births that occurred during 1993-2000, but died before reaching their first birthday. Due to the nature of a cohort file, 2001 live births that resulted in an infant death were not yet available. An additional characteristic examined among the infant death population was age at death. These results are shown in Table 3. Among these mothers, the percentage who lost weight during their pregnancy has increased over time. A smaller percentage of black and other mothers received Adequate prenatal care among those who experienced an infant death. More than half of the infant deaths for each time period and race group have been VLBW. The percentage of infant deaths that were VLBW was substantially higher among black and other mothers in recent years. Approximately 10-15 percent of infant deaths were to mothers delivering a multiple birth.

**Table 3. Selected Maternal Characteristics[1] for all Infant Deaths across Three Time Periods, SC Residence Data**

| | 1993-1995 IMR | | 1996-1998 IMR | | 1999-2001 IMR | |
|---|---|---|---|---|---|---|
| **Characteristics** | **White Percent** | **Black & Other Percent** | **White Percent** | **Black & Other Percent** | **White Percent** | **Black & Other Percent** |
| **Maternal Age** | | | | | | |
| Less than 18 years | 8.9 | 12.4 | 7.3 | 11.5 | 8.1 | 7.2 |
| 18-34 years | 81.9 | 79.4 | 81.6 | 81.1 | 81.4 | 82.2 |
| 35 or more years | 9.2 | 8.2 | 10.9 | 7.2 | 10.2 | 10.4 |
| **Maternal Education** | | | | | | |
| High School or less | 65.1 | 73.9 | 59.5 | 71.0 | 60.1 | 71.0 |
| More than High School | 33.3 | 22.4 | 37.9 | 25.4 | 37.1 | 24.1 |
| **Unmarried Mother** | 22.0 | 68.4 | 19.6 | 63.3 | 24.8 | 63.9 |
| **Hispanic Mother** | 2.2 | 0.8 | 4.3 | 0.4 | 4.2 | 0.3 |
| **Kessner Index of PNC** | | | | | | |
| Adequate | 64.3 | 40.3 | 64.5 | 44.4 | 61.0 | 50.3 |
| Intermediate | 22.1 | 29.8 | 16.8 | 23.9 | 19.5 | 22.9 |
| Inadequate | 11.0 | 22.2 | 12.9 | 24.4 | 12.8 | 20.0 |
| **Smoked during pregnancy** | 26.1 | 12.1 | 29.4 | 8.7 | 22.7 | 6.9 |
| **Drank during pregnancy** | 2.2 | 3.0 | 2.2 | 1.8 | 1.9 | 1.0 |
| **Number at Birth** | | | | | | |
| One | 85.8 | 89.5 | 85.9 | 91.2 | 85.2 | 87.6 |
| Two or more | 14.2 | 10.5 | 14.1 | 8.8 | 14.8 | 12.4 |
| **Weight Gain/Loss** | | | | | | |
| Weight lost | 0.3 | 1.3 | 1.4 | 1.7 | 2.6 | 3.0 |
| 1-24 lbs. gained | 48.6 | 54.4 | 46.6 | 49.0 | 47.3 | 52.6 |
| 25-34 lbs. gained | 25.6 | 13.8 | 15.8 | 16.1 | 20.0 | 14.0 |
| 35+ lbs. gained | 17.2 | 11.0 | 19.9 | 10.3 | 19.5 | 9.6 |
| **Birthweight Group** | | | | | | |
| VLBW | 44.8 | 65.6 | 47.5 | 65.0 | 48.7 | 67.3 |
| MLBW | 15.0 | 11.1 | 14.6 | 12.7 | 12.3 | 12.5 |
| NBW | 40.1 | 23.0 | 37.8 | 22.2 | 39.0 | 20.1 |
| **Age at death** | | | | | | |
| Early neonatal (<7 days) | 52.9 | 62.9 | 52.7 | 61.7 | 52.2 | 60.6 |
| Late neonatal (7-27 days) | 12.9 | 9.9 | 14.3 | 10.9 | 15.1 | 10.7 |
| Postneonatal (>27 days) | 34.2 | 27.2 | 33.0 | 27.4 | 32.7 | 28.7 |

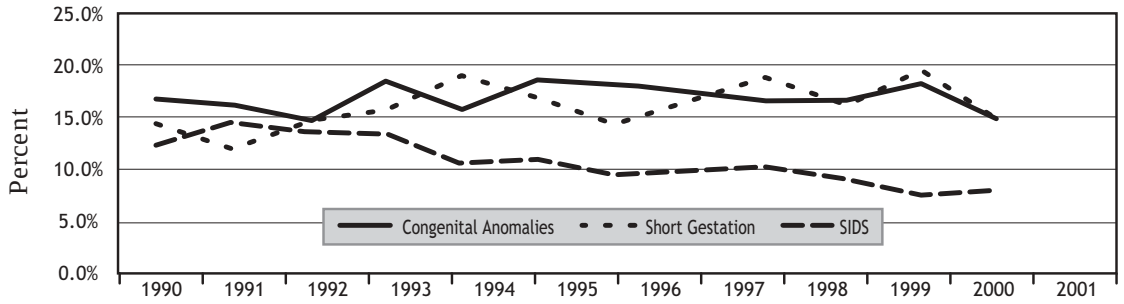
[1] Data is stratified by race of mother.
"Unknown" levels of each variable are not listed, but percentages are based on their inclusion.

## Leading Causes Of Infant Death

Congenital anomalies, short gestation, and Sudden Infant Death Syndrome (SIDS) have been the top three leading causes of infant death in South Carolina for the past decade except SIDS is 4th leading cause of infant death in 2001. Congenital anomalies and short gestation primarily resulted in neonatal deaths, while SIDS deaths were mostly postneonatal.

The percentages were calculated for several leading causes of infant death. This shows the percentage of infant deaths each year due to a specific cause. All rates prior to 1999 have been adjusted using comparability ratios provided by the National Center for Health Statistics; therefore, all rates over this time period are comparable to the rates of 1999 and after. The percentage of infant deaths due to SIDS decreased from 12.4% in 1990 to 7.7% in 2001. The percentages of infant deaths due to congenital anomalies and to short gestation have fluctuated with current percentages about equal at 15.0 percent. These trends are shown in Figure 4.

**Figure 4. Top Three Leading Causes of Infant Death, 1990-2001**
**SC Residence Data**




Note: Percentage has been adjusted in accordance with ICD-9 to ICD-10 changes.
Comparability ratio: Congenital Anomalies: 0.91, SIDS: 1.04, Short Gestation: 1.11

| | 1990 | 1991 | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 | 2000 | 2001 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Con. Anomalies | 16.6% | 16.1% | 14.5% | 18.4% | 15.7% | 18.6% | 18.2% | 17.3% | 16.6% | 16.7% | 18.2% | 15.1% |
| Short Gestation | 14.5% | 12.2% | 14.5% | 15.9% | 19.0% | 16.9% | 14.4% | 16.4% | 18.9% | 16.3% | 19.5% | 14.9% |
| SIDS | 12.4% | 14.7% | 13.6% | 13.4% | 10.7% | 11.1% | 9.8% | 9.9% | 10.4% | 9.0% | 7.6% | 7.7% |

## LBID Linked With PRAMS

Live Birth / Infant Death (LBID) cohort files (1996-2000) were linked with South Carolina Pregnancy Risk Assessment Monitoring System (PRAMS) data. PRAMS is an on-going surveillance system that collects information from South Carolina resident mothers who have recently delivered a live-born infant. The PRAMS survey obtains detailed information about maternal characteristics, attitudes, and behaviors before, during, and shortly after pregnancy.

A descriptive analysis was conducted to examine characteristics for both white mothers and black mothers. Mothers of races other than black and white were excluded from PRAMS analyses due to small numbers.

*Over this five-year time period, the percentage of unmarried black women who delivered a live birth was consistently and substantially higher than the percentage of unmarried white women who delivered a live birth, 73% and 26% respectively.*

The analysis from 1996-2000 PRAMS-linked cohort files revealed a higher percentage of white mothers received Adequate prenatal care, according to the Kotelchuck Index. Percentages of mothers who received Adequate Plus prenatal care were comparable for white and black mothers, and a higher percentage of black mothers received Inadequate prenatal care.

The PRAMS survey asks several questions on tobacco use and alcohol consumption at different times related to the pregnancy. A higher percentage for alcohol and a lower percentage of tobacco consumption were reported according to 1996-2000 PRAMS surveys than reported from birth certificate information. PRAMS showed that 17% of white mothers reported smoking during the third trimester of pregnancy, while less than 5% of black mothers reported third-trimester smoking.

Over this five-year time period, the percentage of unmarried black women who delivered a live birth was consistently and substantially higher than the percentage of unmarried white women who delivered a live birth, 73% and 26% respectively.

Using the same linked LBID / PRAMS dataset for 1996-2000, a preliminary multivariate logistic regression analysis was conducted to reveal characteristics significant in predicting the delivery of VLBW and MLBW infants among South Carolina resident mothers.

Two separate models were run: one for white mothers and one for black mothers. The possible predictors included age, marital status, smoking, drinking, adequacy of prenatal care, pregnancy intention, poverty status, maternal health status and social stressors. Low birthweight was chosen as the outcome due to its strong association with infant death.

Having one or more poor health factors, age, and receiving less than Adequate prenatal care or Adequate Plus prenatal care (indicative of a high-risk pregnancy) were associated with an increased risk of delivering a LBW infant, among white mothers. Poor maternal health status, age, marital status, and adequacy of prenatal care were predictors of delivering a LBW infant among black mothers.

## Geographic Information Systems (GIS) Application

Aggregate maps can give public health professionals the ability to see how a county compares to its neighboring counties or how counties in one health district compare to other health districts across the state. In Figure 5, each county's five-year infant mortality rate was compared with the overall five-year state infant mortality rate of 9.4 infant deaths per 1,000 live births. Three counties in South Carolina had an overall five-year infant mortality rate between 9.4 and 9.7, which was slightly higher than the state rate. Only one county showed a rate slightly lower than the state rate (between 9.0 and 9.4). Fifteen counties showed rates significantly lower than the state rate (less than 9.0), while 27 counties showed rates significantly higher (greater than 9.7). Rates may vary from county to county within each health district. The state's two largest health districts, Pee Dee and Upper Savannah, consist of six counties. In both of these health districts, five of the counties showed rates significantly higher than the state rate while only one county had a rate significantly lower than the state rate. The infant mortality rates of the three counties in the Edisto District were significantly higher than the state rate, while the rates of the two counties in Appalachia II were significantly lower.

## Conclusion And Recommendation

South Carolina's infant mortality rate is no longer declining. Because the causes of infant mortality are complex, continued efforts must be made to investigate contributors toward infant mortality. More effective state and local community efforts must continue so that the complex web of causation for infant mortality can be successfully untangled. It is imperative for mothers to be in optimal health, practice healthy behaviors, and receive the best possible perinatal care in order to promote a healthy pregnancy outcome. As shown, there are big racial and socio-economic disparities (i.e., marital status, education, etc). There is still much work to be done in South Carolina to further reduce these disparities. Collaborative efforts among communities are essential for success in reaching these goals.

Low birthweight, like infant mortality, is a multi-dimensional issue. Since the majority of infant deaths that occur in South Carolina are low birthweight infants, an ultimate goal of decreasing the number of low birthweight infants should in turn yield a decrease in the infant mortality rate and reduce disparities.

*South Carolina's infant mortality rate is no longer declining. Continued efforts must be made to investigate contributors toward infant mortality.*

## Technical Notes

***Congenital Anomalies:*** Refers to the ICD code grouping entitled "Congenital malformations, deformations, and chromosomal abnormalities". This is a rankable cause of infant death according to NCHS guidelines.

***Infant Death:*** A death before the age of one; this does NOT include fetal deaths.

***ICD (International Classification of Disease):*** An established system of categories and criteria by which morbid events are assigned and analyzed.

***Level III Hospital:*** Hospitals classified as Level III are staffed and trained to handle all aspects of perinatal care including high risk and complex neonatal patients.

***Live Birth/Infant Death Cohort:*** This file contains live birth information for each calendar year. In the event of a live birth not surviving the first year of life (an infant death), death certificate information was appended to the infant's birth certificate information.

***Maternal Complications:*** Refers to the ICD code grouping entitled "Newborn affected by maternal complications of pregnancy". This is a rankable cause of infant death according to NCHS guidelines.

***Short Gestation:*** Refers to the ICD code grouping entitled "Disorders related to short gestation and low birthweight, not elsewhere classified". This is a rankable cause of infant death according to NCHS guidelines.

## More About PRAMS

Selected mothers are mailed a survey up to three times. Telephone interviewers attempt to reach the mothers who do not respond by mail. About 2,100 mothers are randomly sampled from the state's live birth registry each year. Low birthweight infants are over-sampled in order to learn more about high-risk mothers. After statistical weights are applied, inferences can be made about the health of all mothers and infants in South Carolina. PRAMS data presented in this analysis reflect live births occurring in South Carolina to South Carolina resident mothers. The overall response rate for the years 1996 through 2001 was 72.9% (8,154 out of 11,190 mothers responded).

For more information about the SC PRAMS program please contact our office at 898-3649 or visit our website at http://scangis.dhec.sc.gov/scan/.

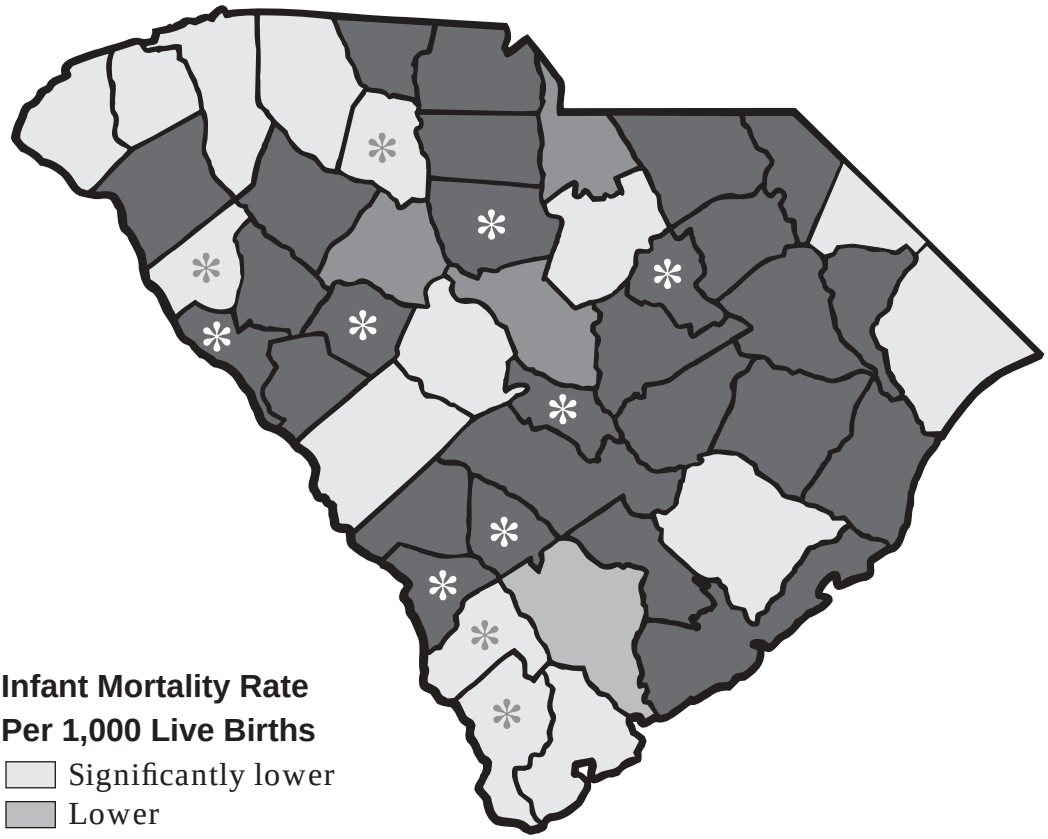
Funding for the SC PRAMS program was provided by the Centers for Disease Control and Prevention, Atlanta, GA (Grant No. U50/CCU413745-04).

## More About GIS

For several years, South Carolina vital records information (births, deaths, cancer, etc.) has been geocoded for GIS applications. Sophisticated geocoding software allows the translation of address information, from sources such as vital records data, into a location or particular point on a map. Point-level maps are highly confidential; therefore, point data is often aggregated up to the county level.

For more information on GIS, please contact the GIS lab: shoultzjj@dhec.sc.gov.

**Figure 5. Five-year infant mortality rates by county in South Carolina, as compared to state five-year infant mortality rate. 1997-2001**



**Infant Mortality Rate**
**Per 1,000 Live Births**

- Significantly lower
- Lower
- 9.4 = state rate
- Higher
- Significantly Higher

Note: ✻ Indicates a rate calculated with 20 or fewer deaths. This rate is unreliable and should be used cautiously.

**Significantly lower** indicates a rate lower than 9.0
**Lower** indicates a rate between 9.0 and 9.4
**Higher** indicates a rate between 9.4 and 9.7
**Significantly Higher** indicates a rate greater than 9.7

There were no county-level rates exactly equal to 9.4

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